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The Pilot Study on Protection of the Three Gorge Reservior Wetland of Yangtze River

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Abstract. Ecological protection of the Three Gorge Reservoir wetland would influence the development of the Yangtze River area and even the whole of northern China. This paper studies the current situation of the Three Gorge Reservoir wetland , and analysising the main threats which the reservoir area facing. And then we proposed ecological wetland protection measures from planning, design ,management system innovation, and the public awareness , in hope to improve the protection and management level of the Three Gorge Reservoir wetland , and leading to deep thinking**.**

Keywords: the Three Gorge Reservoir ; wetland; ecological protection

1. Introduction

The Three Gorges Dam Project brings large economic, social and ecological benefits .Carrying out the research for environmental protection and ecological construction has great significance for economic and social development of surrounding areas, it is also good for people live in harmony with nature

2. Ecological characteristics of the Three Gorge Reservoir wetland

Formed by the interception of the Three Gorge Dam, the Three Gorge Reservoir wetland located at E 105° 17′ —110° 11′ ,N 28° 10′ —32° 13′ ,the junction of Sichuan Basin and the Yangtze River

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Basin, East from Yichang in Hubei Province, and west to Chongqing. The Wujiang River, Jialing River is the two largest tributaries of the reservoir area.

2.1. Rivers feature of the wetland.

The Three Gorge Reservoir has widely distributed water and several tributaries of which including 13 main tributaries, such as the Jialing River, Wujiang River, Daning River, etc .It's the typical Rivers wetland which has a distinct longitudinal gradient change, and the water level in the head of the reservoir is deep while the back dam is shallow.

2.2. Large reservoir features of the wetland

The Three Gorges Reservoir has features such as large area, large capacity, strong capability of water storage and the flood regulation. There is 600 km length , 1.1 km width of the Reservoir, and the total area is about 58000km2.The Three Gorges Reservoir wetlands which have long, narrow lake and many islands have different shapes with other natural lakes (such as,Poyang Lake, Dongting Lake) the large reservoirs (such as Qiandao lake in Zhejiang, Changshou lake in Chongqing) but has a common wetlands characteristic. Poyang Lake, Dongting Lake was became an important wetland reserves in China, the Three Gorges reservoir is should be gradually controlled of the main stream and tributaries wetland to ensure water quality and the natural ecological environment.

2.3. The water-level-fluctuating zone of wetland features.

The Three Gorges Project forms a reservoir area with the maximum water level is 175 m, the minimum water level is 145 m, there are 30m of vertical drop of fluctuating zone, it has many characteristics such as : large changes of area and water level fluctuation ; Water level fluctuation is different from the nature law, water in winter and land in summer[1].The water-level-fluctuating zone in the other natural river of Yangtze River is exist too, but it has small range and fluctuations. While water-level-fluctuating zone of the Three Gorges Project has characteristics of ranging rapidly, lasted long, which resulting in the vegetation selection difficult.

3. Ecological threats to the Three Gorge Reservoir wetland

3.1. The spread of water pollution and silts silting up

After water storage of Three Gorges Project, each year from March to May and from July to October, there are a lot of algals growth in the main tributary of the reservoir, such as Daning River, Goddess River, Big Creek River, Baolong River, Meixi River, Cottage River, Pengxi River,etc, algal blooms occur, and it tends to spread to the mainstream [2].

In June 2003 to August 2006, the total inflow suspended sediment is about 700 million t, the outbound sediment is 259 million t, and the reservoir sediment is 441 million t, sediment ratio of reservoir is reachegd 37%. According to situation, less than 100 years in the future, the reservoir will silt into the river bed, and the benefits will be completely lost.

3.2. Habitat fragmentation and loss of biodiversity.

After the completion of the Three Gorges Reservoir, upstream environmental changed, a large area of continuous habitat fragmented into many small patches; the contact between each patch reduced or even disappeared; during which be barrierred by the new background ;species migration and rivers protect are threatened ;some species (eg Adiantum, Myricaria, sturgeon, white-flag dolphin, etc.) are even to be extinct.

3.3. Overlapping management of resources.

The Three Gorges reservoir area has a diversity of wetland resources. Many of the managements which involve a number of departments related to the institutions including water conservancy department, environmental protection department, urban construction department, mining sector department as well as navigation and aviation department, etc. They go their own way, and always shirk the responsibility, and fighting for the interests of each other, because of the multiple management, that resulting in management difficulties in coordination, abuses in management system and poor decrees and waste of resources.

3.4. Lack of funds.

In order to solve environmental problems of the Three Gorges Project, the government has approved a 10-year pollution-control plan since 2000, but according to the survey from EPA in 2009,it,s completion rate was only 18.6%.The reason is mainly lack of funds .For example, the projects should invest 2.149 billion yuan in the planning, but actually only 345 million central finance funds was put in place, the low rate of the central government funding arrived and big funding gap in the local aere lead to the slow progress of the protection and lack of governance for pollution timely and effective.

3.5. Indifferent public protection awareness.

Many local residents engaged in tourism-related industry in The Three Gorges reservoir, driven by economic interests, some people hunt rare animals, or takes visitors into the protected area though small road privately .These acts conduct a serious threat for wetland systems and biodiversity; And the untreated sewage and garbage are discharged directly into the Yangtze River by residents and tourists ,which bring the water pollution in varying degrees

4. The ecological countermeasures of wetland protection in the Three Gorges Reservoir

To improve the stability of the Three Gorges Reservoir wetland, this paper will discuss it from the respect of urban planning, the management and system innovation, and the public awareness

4.1. Point— Line control.

Based on the respect for nature, focusing on ecological restoration, we can put the Three Gores Area regarded as the collection of point-line-Surface. Applying by the theory of plaque-corridor-matrix to make the planning well. Point(plaque)—establish a number of wetland reserves, divided areas according to the characteristics of areas, and hoping to stimulate other areas by this way; line—that is ecological corridor design, through the form of the corridors connecting the function flow and maintaining energy smoothly, numerous ecological corridor make up the system of the Three Gorge Reservoir wetland.

4.2. Point—establish nature reserves, divided area reasonable, Serve as a model.

At present, the most effective way to protect the rare plants and animals is to establish nature reserves, and the key work of the planning and management is the functional partitions after establishing the nature reserve. According to Technical code for Master Plan of the nature reserve ,the nature reserve divide into the core area , buffer area and experimental areas, all of the three partitions are the structure of concentric circles, but generally speaking ,this is limited to terrestrial ecosystem which have low environment heterogeneity. It is lacks of theoretical breakthrough for different regions, different habitats and different protection on objects of nature reserves [3]. That requires planning to be innovative. According to different types of reserves, we should starting from the personality, Centering on the protection of a specific object,s needs, use the theory of 'structure determines function' to divided area of wetland reserve.

Table 1 The birds proportion of AnLan herons nature reserve

Nature reserve	Residence type	Migratory bird of summer	Migratory bird of winter	Resident birds	Migratory birds
AnLan herons nature reserve	Number of species	22	12	53	2
	Proportion [%]	24.72	13.48	59.35	2.25

Finishing according to material 4

Take Alan Herons Nature Reserve for example, from the Table 1 above, we can be seen that there are vast of majority of resident birds, migratory bird are also take sizable parts of the proportion. In accordance with the theory of habitat suitability, Planning should according the situation of AnLan herons nature reserve, and the migratory birds, seasonal feature which come to breeding or pass the winter, and then analyzes the geographic distribution of rare migratory birds ,the area of feeding, the rule and time of migrate, and finally combination with these factors to be divided areas in different management strategies, the situation is as Table 2.

Table 2 The Function division of AnLan herons nature reserve

Functional area	The range	The management strategy	Importance of status
Core area	Areas with resident birds to life-bearing, water which Herons overnight, accommodation,foraging,habitat and the stopover for migratory birds.	Prohibitting reclamation fishing, tourism and other man-made damage, Strictly protected, research and education can be done.	★★★★★
Core area on the specified season	According to the time of migratory birds migrated, divided strictly protected area with the feeding/ the rule and time of migrate of which will turn to be experimental area when migrant left.	Management in accordance with the core area during migratory birds breeding and winter in other times manage by experimental area.	★★★★
Buffer area	Area which play an Important and complementary role of aherons' to overnight ,foraging ,habitat, accommodation.	The same management strategy as the Core area.	★★★
Experiment-al area	It is still belongs to the wetland ecosystem, part of the area which far away from the core and buffer area, it may affect the herons' foraging.	Tourism can be developed, but it must regulate by the standard, no other damage activities.	★★

4.3. Line—establish the ecological corridor of the wetland of Three Gorges Reservoir.

The nature reserves protect the habitats of endangered species effectively, but natural habitats are small islands in the sea of human environment. Area loss and fragmentation affect seriously the survival of species, for small, isolated populations are exposed to several risks. As the area of suitable habitats decreases, one way to escape local extinction is to migrate between habitats through ecological corridors [5].

The corridor should include a variety of environmental gradient types, It can conduct a comprehensive analysis by using 3S technology to determine the best location of each corridor; And to different conservation goals determine the different width by function; On the premise of meeting the basic functions, the more the number of corridors, the smaller probability of eco-trapped and segmentation, and the wetland system is also more and more stable.

Due to the people, activities, the habitat fragmentation and the plaques are away from each other, corridor planning is to increase the connectivity between broken patches, the Three Gorge Reservoir wetland is belong to the type of river-type, the stream always have the functions of material transport, energy flow, species migration etc. The key factors that can impact the structure of corridor are corridor width and its surrounding environment, the reservoir characteristics of animal and plant species, the species composition, the shape and continuity of corridor, and the relations between ecological corridor and surrounding plaques or the matrix [6]. Finally, the vertical structure of The Three Gorge Reservoir wetland should be formed a beaded structure which constitute by a series of small corridors and connect the various large-scale natural plaques.

5. System Innovation.

5.1. Establish the ecological compensation system of wetland.

According to the value of ecosystem services, ecological protection costs, and development opportunity costs, ecological compensation is the legal system which based on the purpose of the protection of the ecological environment using means of government and market-based instruments to regulate interests between the stakeholders of ecological protection [7].

1)Subject and object of compensation .According to principle of "Who benefits whom compensation", Yangtze River region and even to the country are benefited from the Three Gorges Project, So they should bear the responsibility for ecological compensation. And the subject of the compensation of the Three Gorges Reservoir is: everybody get profits from the Three Gorges Reservoir and the enterprises that polluted garbage into the reservoir. While the objects are farmers, urban residents, and local governments who damage themselves interests but protect the ecological.

2) The ways of ecological compensation .There are several ways of ecological compensation for the Three Gorge Reservoir wetland as the Table 3 below:

Table 3 Ways of ecological compensation of the Three Gorge Reservoir wetland

Compensat-ion Type	Government compensation	Financial compensation	Material compensate-ion	Project compensation	Intelligence and Technology Compensation
Content	The compensation of preferential policies for reservoir	Transfer some financial for the establish the eco-construction or ecological fund	Compensa-tion for material losses	The implementation of ecological projects and development projects in different places	provide the reservoir with technical and personnel support, training and transfer of reservoir labor
Practice and case	Preferential loans, tax reduction, etc.	levied sewage charges , ecological benefit compensation fund of forest ,etc.	Providing food and material to the reservoir, etc.	Support for returning farmland to forest, nature reserves and other projects, etc.	Provide technology for the development of energy-saving transport ,etc.

5.2. Perfecting laws and regulations, integrating cross-border management.

At present, the major problem for us is the conflict between several regional managements. The most effective way to solve the problem is: change "regional management" to the "public administration". First of all, to integrated the various districts wetland management, It is necessary to establish the overall concept and build a unified authority management; Secondly, improve monitoring and early warning mechanisms: we should form the basis of early-warning consultation offices by the various local government's environmental protection departments, meteorological departments, etc, and set up the long-term programs.

5.3. Strengthening international cooperation and communication.

The foreign success experience on the wetlands is valuable for the ecological protection of the Three Gorges reservoir. Strengthening contacts with the relevant international organizations, promote various aspects communication of information, experience, and research methods are good for us to improve the wetland management and production .

5.4. Public participation—raising public awareness and encouraging public participation in environmental protection of wetlands.

Broad public participation is essential for sustainable watershed management, Principle 10 of the Rio Declaration on Environment and Development emphasized that citizens should have access to information and opportunities to participate in environmental decision-making processes (UN, 1992). The European Union has stressed public consultation, especially on environmental issues [8]. It can increase public awareness of protection through various channels in our country: For example, the government and relevant departments can establish special ecological protection units; in the community we can carry out public education related to wetland, and provide the residents manuals, video about wetland; we can also set up education center in exhibition or use wetland nature reserves to spread knowledge of the wetlands on the scene.

Conclusion

All in all ,for the problems of reservoir wetland, I believe that we can slove it from the following aspects: on the urban planning, it should establish the nature reserve which have a reasonable division of function zoning, and then design the wetland ecological corridor; on the management and system innovation, it should build ecological compensation system of wetland, improve the legislation and management level and strengthen international cooperation; on the social consciousness, it should raise public awareness and encourage public participation in the wetland protection .Only in this way , the Three Gorges reservoir wetland can play a greater ecological efficiency.

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